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(54) **CIRCUIT BREAKER WITH IMPROVED IMPACT RESISTANCE**

SCHUTZSCHALTER MIT VERBESSERTER SCHLAGFESTIGKEIT

COUPE-CIRCUIT A RESISTANCE ACCRUE AU CHOC

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Description

BACKGROUND OF THE INVENTION

1. FIELD OF THE INVENTION

[0001] This invention relates generally to electric circuit breakers and more particularly to circuit breakers with improved impact resistance.

2. DESCRIPTION OF THE RELATED ART

[0002] Circuit breakers are commonly used for temporary interruption of electrical power to electrical devices (loads). Various circuit breaker mechanisms have evolved and have been perfected over time on the basis of application-specific factors such as current capacity, response time, and the type of reset (manual or remote) function desired of the breaker.

[0003] One type of circuit breaker mechanism employs a thermo-magnetic tripping device to trip a latch in response to a specific range of over-current conditions. In another type of circuit breaker, referred to as a double-break circuit breaker, two sets of current breaking contacts are included to accommodate a higher level of over-current conditions than can be handled by one set of contacts. The mechanical and electrical assembly that is typical of those used in circuit breakers of the present invention have been described before. For this reason United States Patent No. 5,430,419 is incorporated herein by reference in its entirety.

[0004] In general, the present invention pertains to the durability and impact resistance of circuit breakers. Prior art circuit breakers, as described below with reference to **FIG. 1**, have smooth opposing planar sides with a small-diameter pivot extending from each side. If the prior art circuit breaker were accidentally dropped on the lever extending from the handle, the pivots may shear off. Alternatively, the lever may receive a blow in some other manner. In any case, there is a risk that the pivots may break, allowing the handle to be jammed into the internal electro-mechanical assembly. If this happens, the circuit breaker is ruined and/or rendered inoperable and must be replaced. Thus, it is desirable to have a circuit breaker with improved durability and impact resistance.

[0005] The present invention provides a circuit breaker for interrupting power in a circuit path between a source and a load, comprising: an electro-mechanical assembly including first and second contacts cooperatively arranged in the circuit path for providing current from the source to the load, wherein at least one of the contacts is movable for interrupting the power provided to the load; a pivotable integral switch handle operatively connected to the electro-mechanical assembly for making and breaking the circuit path, the handle having a body having curved sides and opposing first and second planar sides, a lever extending from a curved side, characterised in that said circuit breaker further comprises a first hub extending from the first planar side and forming a first shoulder therewith, a first pivot extending from the first hub, a base coupled to the electro-mechanical assembly and the handle, the base having a first elongate bearing slot in contact with the first pivot; a cover coupled to the electro-mechanical assembly and the handle, and coupled to the base, the cover having a second elongate bearing slot, a second pivot reposing in the second elongate bearing slot; a first bearing surface in the base for receiving said first shoulder; a second hub extending from the second planar side and forming a second shoulder therewith; a second pivot extending from the second hub; and a second bearing surface in the cover adapted to receive the second shoulder.

[0006] In a preferred embodiment, the circuit breaker further comprises first and second projections formed integral with a curved side of the body. Preferably, the first and second projections have opposing first and second bearing forks. A blade engages the first and second bearing forks, and a spring engages the blade, in a preferred embodiment. Preferably, the first and second elongate bearing slots have opposing ends and the blade and spring cooperate to press the first and second pivots against one end of the first and second elongate bearing slots. With this arrangement, when a force is applied to the lever, the first and second pivots slide in the first and second elongate bearing slots until the first and second shoulders engage the first and second bearing surfaces, respectively. This prevents the shearing or breaking of the first and second pivots, when such a force is applied. Thus, the circuit breaker is more durable.

[0007] Examples of the more important features of the invention have been summarized rather broadly in order that the detailed description thereof that follows may be better understood, and in order that the contributions to the art may be appreciated. There are, of course, additional features of the invention that will be described hereinafter and which will form the subject of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] For detailed understanding of the present invention, references should be made to the following detailed description of the preferred embodiment in conjunction with the accompanying drawings, in which like elements have been given like numerals and wherein:

FIG. 1 shows an isometric view of the handle of a circuit breaker according to the prior art.

FIG. 2 shows an isometric view of the handle of a circuit breaker according to the present invention.

FIG. 3 shows an elevation of the handle of **FIG. 2**.

FIG. 4 shows an isometric view of the base of a circuit breaker housing according to the present invention.

FIG. 5 shows an isometric view of the cover of a circuit breaker housing according to the present invention.

FIG. 6 shows a plan view of a base assembly of a circuit breaker with its electro-mechanical assembly and handle according to the present invention.

FIG 7 is a cross-section of a base and handle as would be seen in the reverse direction of the plan view in **FIG. 6. FIG 7** illustrates the normal position of a pivot in a bearing slot.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0009] Conventional circuit breakers contain a handle for manual operation of the device. Typically, the handle rotates on a pivot. When a relatively large external force is applied along the axis of such a handle (e.g. the circuit breaker is dropped), the pivot may break because the small cross section of the pivot is unable to withstand ensuing shear stresses. The breaking of the pivot allows the handle to be pushed inside the breaker, causing internal damage to the circuit breaker and rendering it inoperable.

[0010] **FIG. 1** shows an isometric view of a switch handle **10** of a circuit breaker according to the prior art. Referring to **FIG. 1**, the handle **10** comprises a lever **12**, and a pivot **14**. A second opposing pivot is provided, but not shown. When a circuit breaker having a prior art handle **10** is inadvertently dropped on the handle **10,** the pivots 14 tend to shear off. This allows the handle 10 to be pushed inside the breaker, causing damage to the assembly within and rendering the circuit breaker inoperable.

[0011] FIG. 2 shows an isometric view of a switch handle 20 of a circuit breaker according to the present invention, and FIG. 3 shows an elevation of the same. The handle 20 comprises a body 22, curved sides 24, and planar sides 26a, 26b. A lever 28 provides a means of pivoting the handle 20. Unlike the prior art, hubs 30a, 30b project or extend from the planar sides 26. Like elements differentiated by an alpha character are referenced solely by the numeric identifier when differentiation is unnecessary. The hubs 30 form shoulders 32a, 32b with the planar sides 26. Pivots 34a, 34b extend or project from the hubs 30a, 30b, respectively. Forked projections 36a, 36b are formed integral with the body 22. The forked projections 36a, 36b have opposing first and second bearing forks 38a, 38b.

[0012] FIG. 4 shows an isometric view of a base 40 of the housing of a circuit breaker according to the present invention. The base 40 is adapted to receive an electro-mechanical assembly (discussed below) and the handle 20. An elongated bearing slot 42a is recessed into the base 40 to receive the pivot 34a. The base 40 has a bearing surface 44a adapted to receive the shoulder 32a. Likewise, as shown in an isometric view in FIG. 5, a circuit breaker has a cover 50 adapted to receive the electro-mechanical assembly discussed below and the handle 20. An elongated bearing slot 42b is recessed into the cover 50 to receive the pivot 34b. The cover 50 has a bearing surface 44b adapted to receive the shoulder 32b.

[0013] FIG. 6 shows a plan view of a base assembly 60 of a circuit breaker with its electro-mechanical assembly and handle 20 according to present invention. Although, FIG. 6 shows several details of the circuit breaker base assembly 60, only a limited discussion of the various components are discussed herein. As discussed earlier, U.S. Pat No. 5,430,419 provides a detailed discussion of a circuit breaker and is incorporated herein by reference. That patent is assigned to the present assignee, as well, and should be referenced for a more detailed discussion of the operation of a circuit breaker. The base assembly 60 contains a stationary contact 63 and a mating rotatable blade contact 62. The rotatable blade contact 62 is welded to a blade 64. The blade 64 rotates in the first and second bearing forks 38a, 38b in response to manual operation of the handle 20 or a trip of the circuit breaker. The contact blade 62 is biased by an extension spring 66 which is secured at one end to a retaining member 68 of the contact blade 62 and at the other end to a retaining member (not shown) on the trip lever 70. The trip lever 70 is latched by the magnetic armature 72. Upon manual rotation of the lever 28, the contact blade 62 either opens or closes the circuit via the movable contact 62 and the stationary contact.

[0014] FIG. 7 illustrates the normal position of the pivot 34 in the elongated bearing slot 42. FIG. 7 is a cross-section of a base and handle as would be seen in the reverse direction of the plan view in FIG. 6. The pivot 34 is normally pressed against one end of the elongated bearing slot 42. This is the normal position because the spring 66 forces the blade 62 into the bearing forks 38, which pushes the body 22 until the pivots 34 rest against one end of the elongated bearing slots 42. However, as best seen in FIGS. 4 and 5, if a force is applied to the lever 28 in the direction of the body 22, the pivots 34 will slide within the elongated bearing slots 42 until the shoulders 32 contact the bearing surfaces 44. In this manner the force is distributed over the bearing surfaces 44 rather than being absorbed by the pivots 34. The radius of the bearing surfaces 44 matches with the radius of the shoulders 32, distributing such a force over a greater area than can be provided by the pivots 34 and a circular bearing recess for the pivots.

[0015] Because of the described motion of the pivots 34, a force applied on the lever 28 does not cause shearing action on the pivot 34, but instead transfers the ap-

plied load to the base bearing surface 44a and the cover bearing surfaces 44b. The sum of the areas of the base bearing surface 44a and the cover bearing surfaces 44b are much larger than that of the contact area of pivots in circular bearings. Also, the diameter of the hubs 30 are sufficiently great to withstand a shearing force when a force is applied to the handle 20 via the lever 28. In normal operation, only the friction of the small pivot 34 is experienced because the shoulder 32 is not in contact with the bearing surface 44. Yet, when needed to withstand a blow, the hub 30 takes the stress as the shoulder 32 moves into contact with the bearing surface 44, while the pivot 34 slides out of harm's way.

[0016] Typically, the handle 20, base 40, and cover 50 are molded in a thermoset material. The electro-mechanical assembly is assembled onto and into the base 40. The switch handle 20 is installed concurrently with the electro-mechanical assembly. The pivot 34a is inserted into the elongated bearing slot 42a. The blade 62 is fitted into the bearing forks 38. The cover 50 is assembled onto the base 40 taking care to align the pivot 34b into the elongated bearing slot 42b. Generally, the cover 50 is riveted to the base 40 after the internal components are assembled. The completed circuit breaker assembly can be shipped for field installation or be installed at the factory. In any case the circuit breaker built according the present invention is durable and impact resistant. The switch handle 20 can withstand a significant amount of force without breakage. Since the hubs 30 are strong, it is preferable that the bearing surfaces 44 be molded into a sufficiently substantial structure so that the system of hubs 30, shoulders 32 and bearing surface 44 can withstand a significant impact.

[0017] The foregoing description is directed to particular embodiments of the present invention for the purpose of illustration and explanation. It will be apparent, however, to one skilled in the art that many modifications and changes to the embodiment set forth above are possible without departing from the scope of the invention. It is intended that the following claims be interpreted to embrace all such modifications and changes.

Claims

1. A circuit breaker for interrupting power in a circuit path between a source and a load, comprising:

   (a) an electro-mechanical assembly including first and second contacts cooperatively arranged in the circuit path for providing current from the source to the load, wherein at least one of the contacts is movable for interrupting the power provided to the load;

   (b) a pivotable integral switch handle (20) operatively connected to the electro-mechanical assembly for making and breaking the circuit path, the handle having:

   a body (22) having curved sides (24) and opposing first and second planar sides (26a, 26b), and

   a lever (28) extending from a curved side (24), **characterised in that** said circuit breaker further comprises;

   a first hub (30a) extending from the first planar side (26a) and forming a first shoulder (32a) therewith,

   a first pivot (34a) extending from the first hub (30a),

   (c) a base (40) coupled to the electro-mechanical assembly and the handle (20), the base (40) having a first elongate bearing slot (42a) in contact with, the first pivot (34a);

   (d) a cover (50) coupled to the electro-mechanical assembly and the handle (20), and coupled to the base (40), the cover (50) having a second elongate bearing slot (42b), a second pivot (34b) reposing in the second elongate bearing slot (42b);

   (e) a first bearing surface (44a) in the base adapted to receive said first shoulder;

   (f) a second hub (30b) extending from the second planar side (26b) and forming a second shoulder (32b) therewith;

   (g) a second pivot (34b) extending from the second hub; and

   (h) a second bearing surface (44b) in the cover adapted to receive the second shoulder.

2. The circuit breaker of claim 1 further comprising first and second projections formed integral with a curved side of the body, the first and second projections having opposing first and second bearing forks.

3. The circuit breaker of claim 2, further comprising a blade engaged with the first and second bearing forks.

4. The circuit breaker of claim 3, further comprising a spring engaged with the blade.

5. The circuit breaker of claim 4, wherein the first and second elongate bearing slots have opposing ends and the blade and spring cooperate to press the first and second pivots against one end of the first and second elongate bearing slots, so that when a force is applied to the lever, the first and second pivots slide in the first and second elongate bearing slots until the first and second shoulders engaged the first and second bearing surfaces, respectively, preventing a shear force on the first and second pivots.

Patentansprüche

1. Schutzschalter zum Unterbrechen eines Schaltkreispfads zwischen einer Quelle und einer Last, aufweisend:

(a) Eine elektromechanische Anordnung mit einem ersten und einem zweiten Kontakt, die im Schaltkreispfad zusammenwirken, um der Last von der Quelle einen Strom zuzuführen, wobei wenigstens einer der Kontakte beweglich ist, um die Stromzufuhr zur Last zu unterbrechen,

(b) einen schwenkbaren, einteiligen Schaltgriff (20), der mit der elektromechanischen Anordnung zum Schließen und Unterbrechen des Stromkreises antriebsmäßig gekuppelt ist, wobei der Griff aufweist:

einen Rumpf (22) mit bogenförmigen Seiten (24) und gegenüberliegenden ersten und zweiten ebenen Seiten (26a, 26b), und

einen Hebel (28), der sich von einer bogenförmigen Seite (24) aus erstreckt,

dadurch gekennzeichnet, daß
der Schutzschalter weiterhin aufweist:

eine erste Nabe (30a), die sich von der ersten ebenen Seite (26a) aus erstreckt und damit eine erste Schulter (32a) bildet,

einen ersten Drehzapfen (34a), der sich von der ersten Nabe (30a) aus erstreckt,

(c) einen Sockel (40), der mit der elektromechanischen Anordnung und dem Griff (20) gekuppelt ist, wobei der Sockel (40) einen ersten Längslagerschlitz (42a) hat, der an dem ersten Drehzapfen (34a) anliegt,

(d) einen Deckel (50), der mit der elektromechanischen Anordnung und dem Griff (20) und mit dem Sockel (40) gekuppelt ist, wobei der Deckel (50) einen zweiten Längslagerschlitz (42b) und einen zweiten Drehzapfen (34b), der in dem zweiten verlängerten Lagerschlitz (42b) sitzt, hat,

(e) eine erste Lagerfläche (44a) in dem Sockel, die die erste Schulter aufnehmen kann,

(f) eine zweite Nabe (30b), die sich von der zweiten ebenen Seite (26b) aus erstreckt und damit eine zweite Schulter (32b) bildet,

(g) einen zweiten Drehzapfen (34b), der sich von der zweiten Nabe aus erstreckt, und

(h) eine zweite Lagerfläche (44b) in dem Deckel, der die zweite Schulter aufnehmen kann.

2. Schutzschalter nach Anspruch 1, weiterhin aufweisend einen ersten und einen zweiten Vorsprung, die einstückig mit einer bogenförmigen Seite des Rumpfes gebildet sind, wobei der erste und der zweite Vorsprung gegenüberliegende erste und zweite Lagergabeln haben.

3. Schutzschalter nach Anspruch 2, weiterhin aufweisend eine Klinge, die an der ersten und zweiten Lagergabel angreift.

4. Schutzschalter nach Anspruch 3, weiterhin aufweisend eine Feder, die an der Klinge angreift.

5. Schutzschalter nach Anspruch 4, bei dem der erste und der zweite Längslagerschlitz gegenüberliegende Enden haben und die Klinge und die Feder zusammenwirken, um den ersten und den zweiten Drehzapfen gegen ein Ende des ersten und des zweiten Längslagerschlitzes zu drücken, so daß, wenn eine Kraft auf den Hebel aufgebracht wird, der erste und der zweite Drehzapfen im ersten und zweiten Längslagerschlitz gleiten, bis die erste und die zweite Schulter jeweils an der ersten und der zweiten Lagerfläche eingreifen, wodurch eine Scherkraft am ersten und zweiten Drehzapfen verhindert wird.

Revendications

1. Coupe-circuit pour interrompre l'alimentation dans une ligne de circuit entre une source et une charge, comprenant :

(a) un ensemble électromécanique incluant des premiers et deuxièmes contacts disposés de façon à coopérer dans la ligne de circuit pour délivrer un courant de la source à la charge, dans lequel au moins un des contacts est mobile pour interrompre l'alimentation fournie à la charge ;
(b) une poignée d'interrupteur intégrée pivotante (20) connectée de façon opérationnelle à l'ensemble électromécanique pour établir et interrompre la ligne de circuit, la poignée comportant :

- un corps (22) ayant des côtés incurvés (24) et des premier et deuxième côtés plans opposés (26a, 26b), et
- un levier (28) s'étendant depuis un côté incurvé (24),

caractérisé en ce que ledit coupe-circuit comporte, en outre ;

- un premier maneton (30a) s'étendant depuis le premier côté plan (26a) et formant un premier épaulement (32a) avec celui-ci,
- un premier pivot (34a) s'étendant depuis le premier maneton (30a),

(c) une base (40) couplée à l'ensemble électromécanique et à la poignée (20), la base (40) ayant une première fente de support allongée (42a) en contact avec le premier pivot (34a) ;
(d) un couvercle (50) couplé à l'ensemble électromécanique et à la poignée (20), ainsi qu'à la base (40), le couvercle (50) ayant une deuxième fente de support allongée (42a), un deuxième pivot (34b) reposant dans la deuxième fente de support allongée (42b) ;
(e) une première surface de support (44a) dans la base, adaptée à recevoir ledit premier épaulement ;
(f) un deuxième maneton (30b) s'étendant depuis le deuxième côté plan (26b) et formant un deuxième épaulement (32b) avec celui-ci ;
(g) un deuxième pivot (34b) s'étendant depuis le deuxième maneton ; et
(h) une deuxième surface de support (44b) dans le couvercle, adaptée à recevoir le deuxième épaulement.

2. Coupe-circuit selon la revendication 1, comprenant en outre des première et deuxième saillies formées de façon intégrale avec un côté incurvé du corps, les première et deuxième saillies ayant des première et deuxième fourches de support opposées.

3. Coupe-circuit selon la revendication 2, comprenant en outre une lame insérée dans les première et deuxième fourches de support.

4. Coupe-circuit selon la revendication 3, comprenant en outre un ressort engagé avec la lame.

5. Coupe-circuit selon la revendication 4, dans lequel les première et deuxième fentes de support allongées ont des extrémités opposées et la lame et le ressort coopèrent pour pousser le premier et deuxième pivots contre une extrémité des première et deuxième fentes de support allongées, de manière à ce que, lorsqu'une force est appliquée au levier, les premier et deuxième pivots glissent dans les première et deuxième fentes de support allongées jusqu'à ce que les premier et deuxième épaulements viennent au contact des première et deuxième surfaces de support, respectivement, en empêchant l'apparition d'une force de cisaillement sur les premier et deuxième pivots.

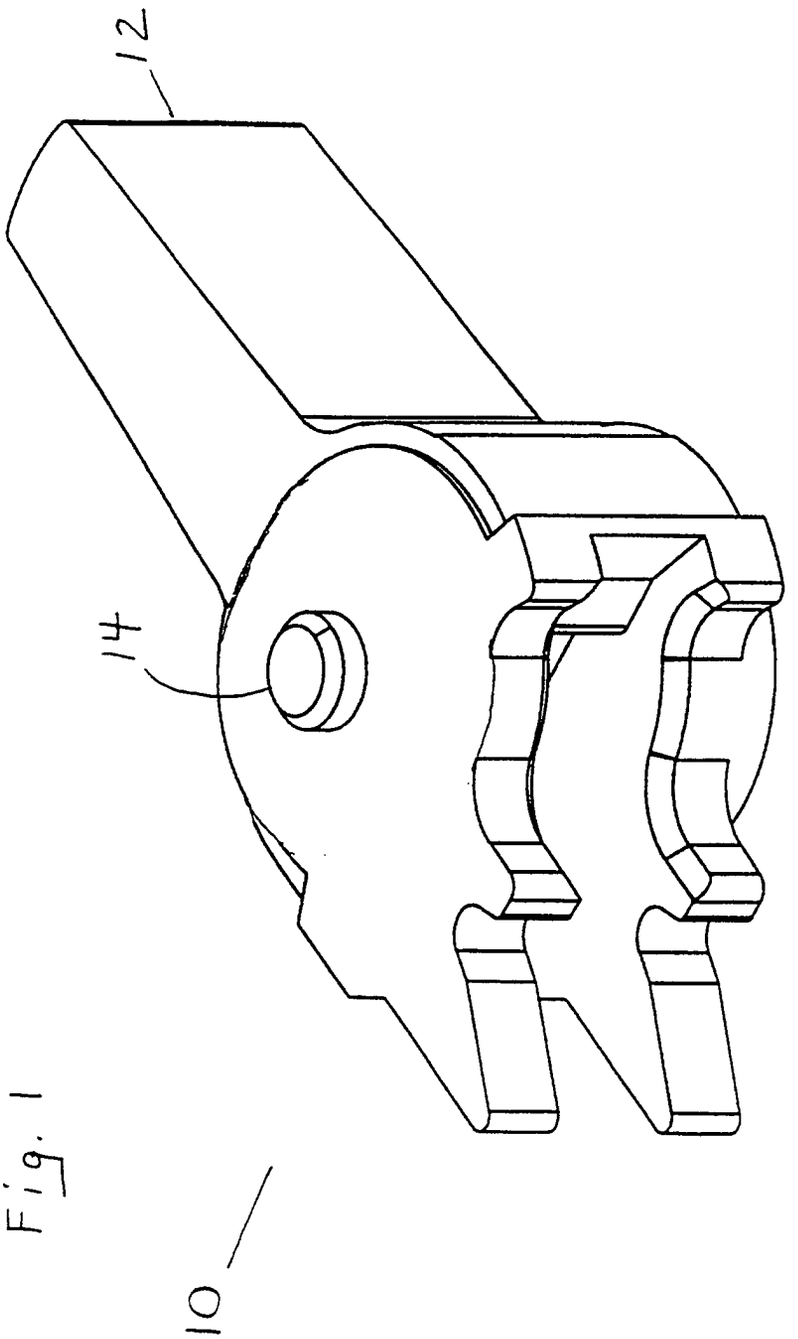


Fig. 1

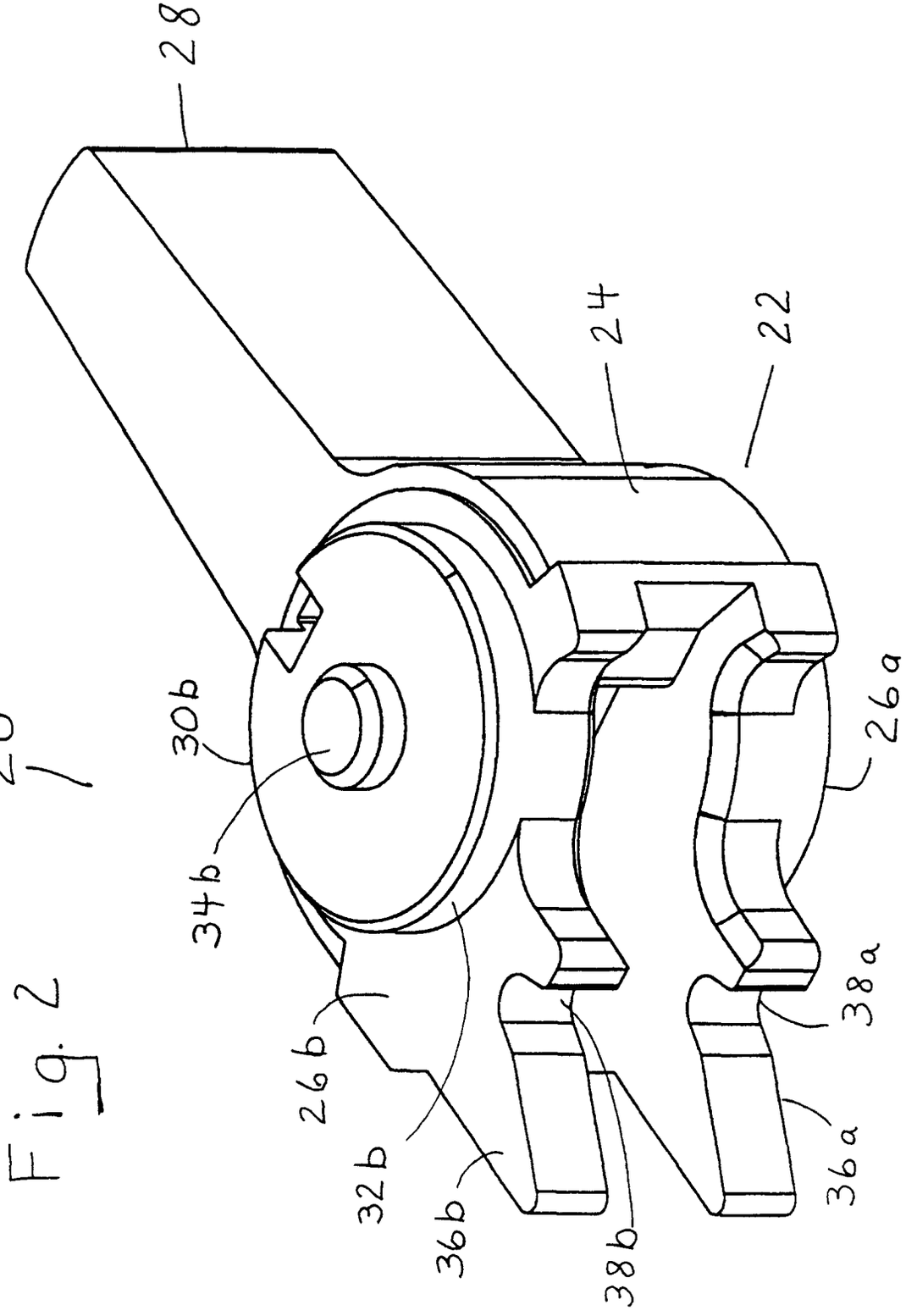


Fig. 2

Fig. 7

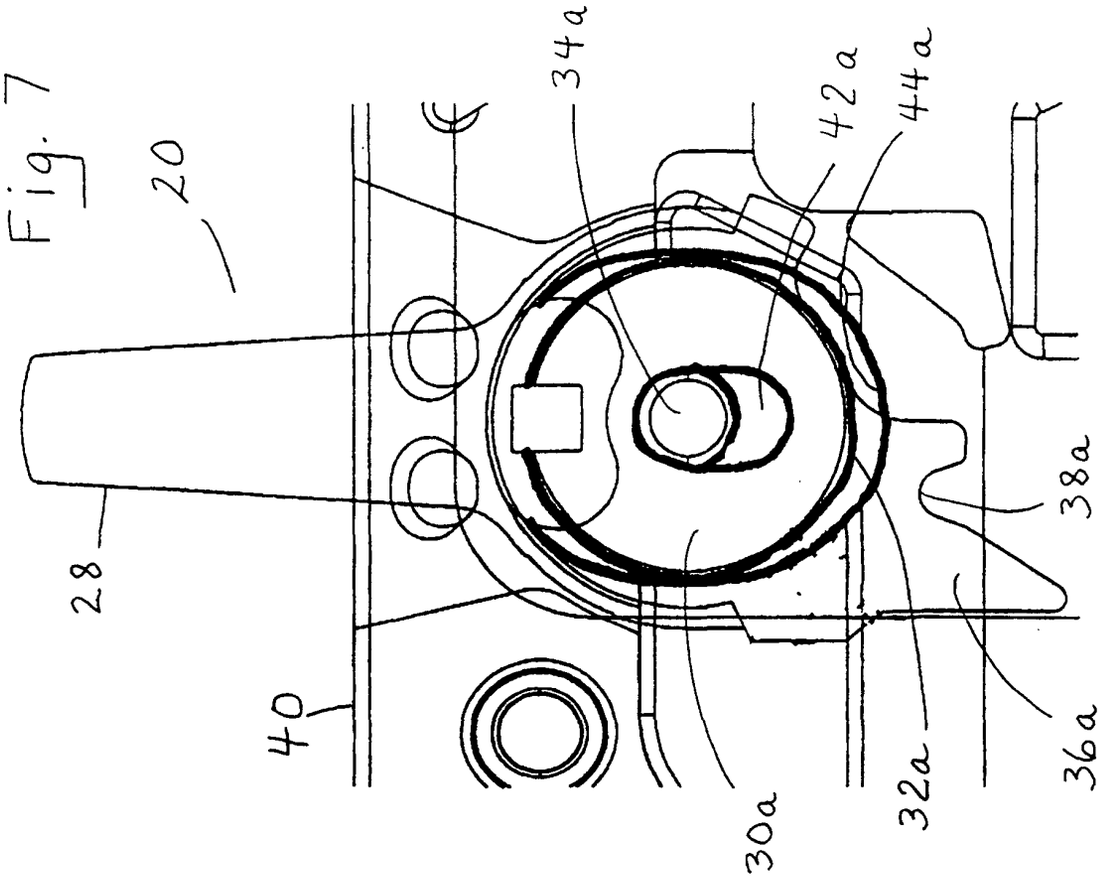

20
28
40
34a
42a
44a
38a
30a
32a
36a

Fig. 3

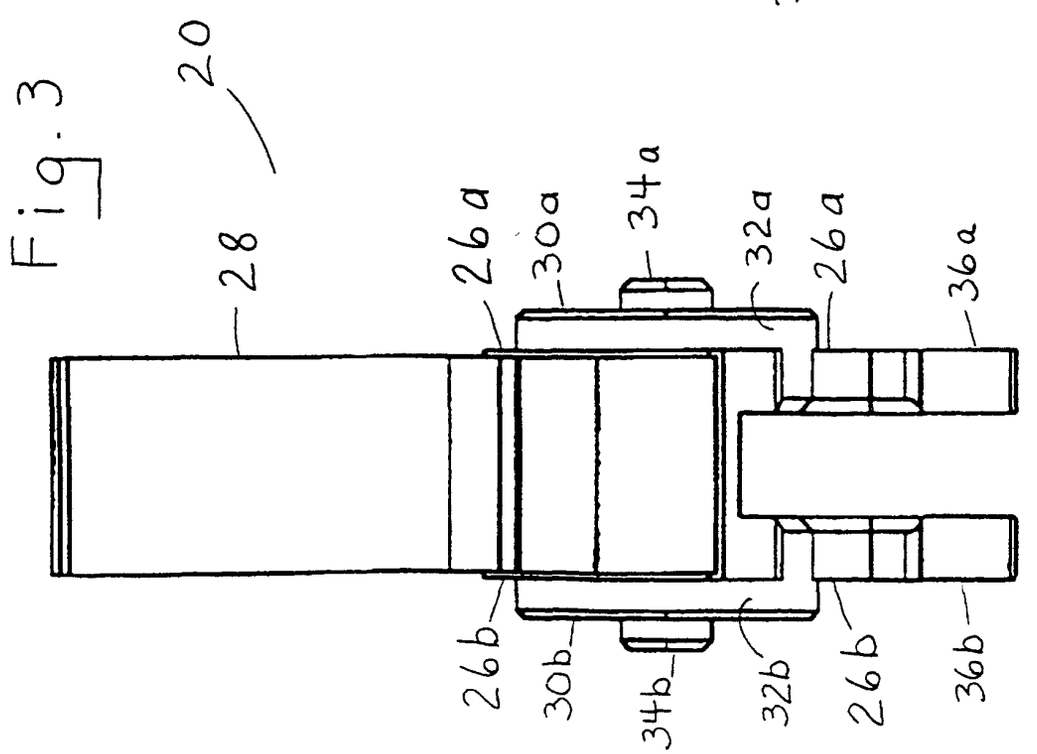

20
28
26a
30a
34a
32a
26a
36a
26b
30b
34b
32b
26b
36b

Fig. 4

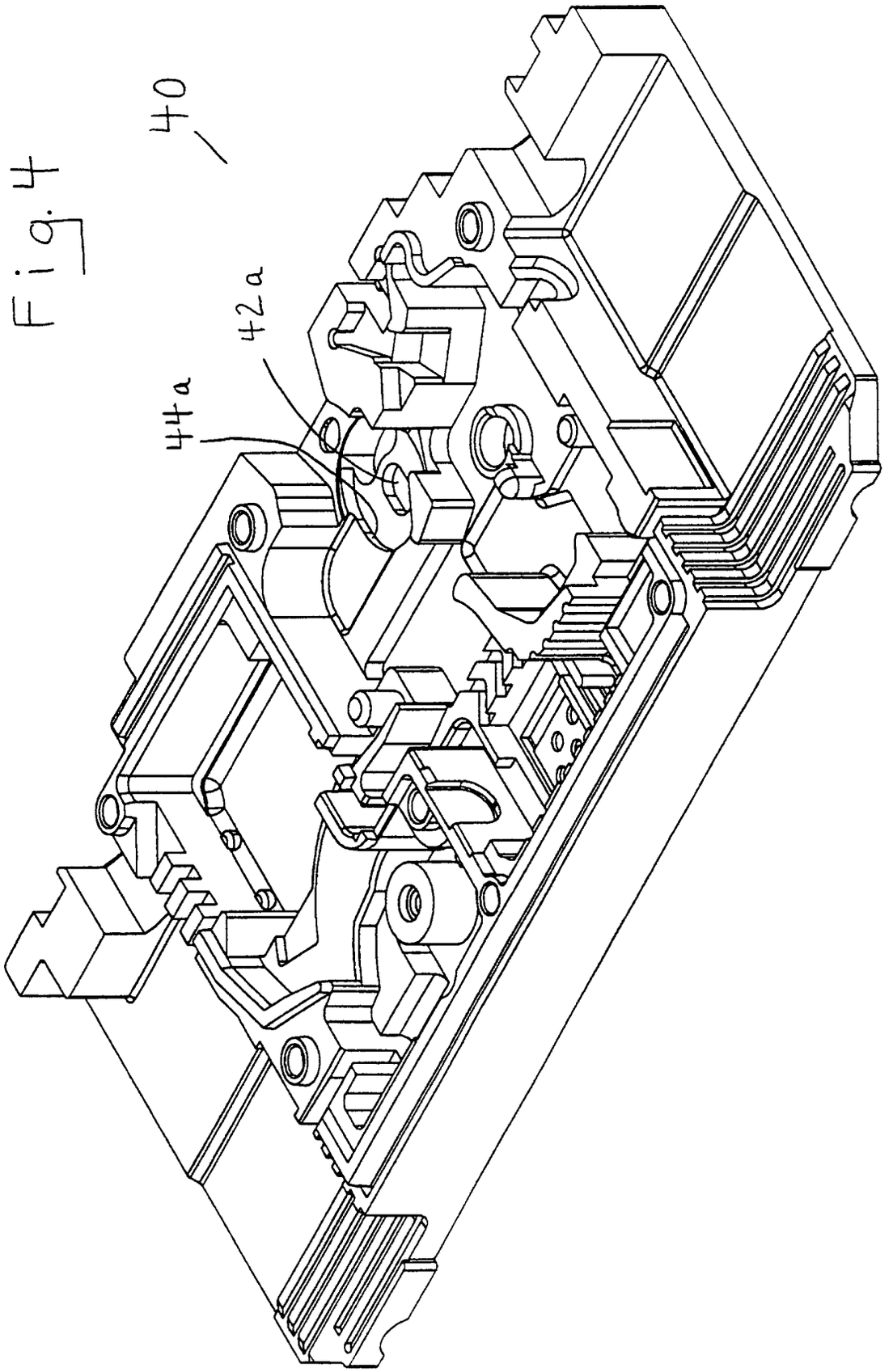
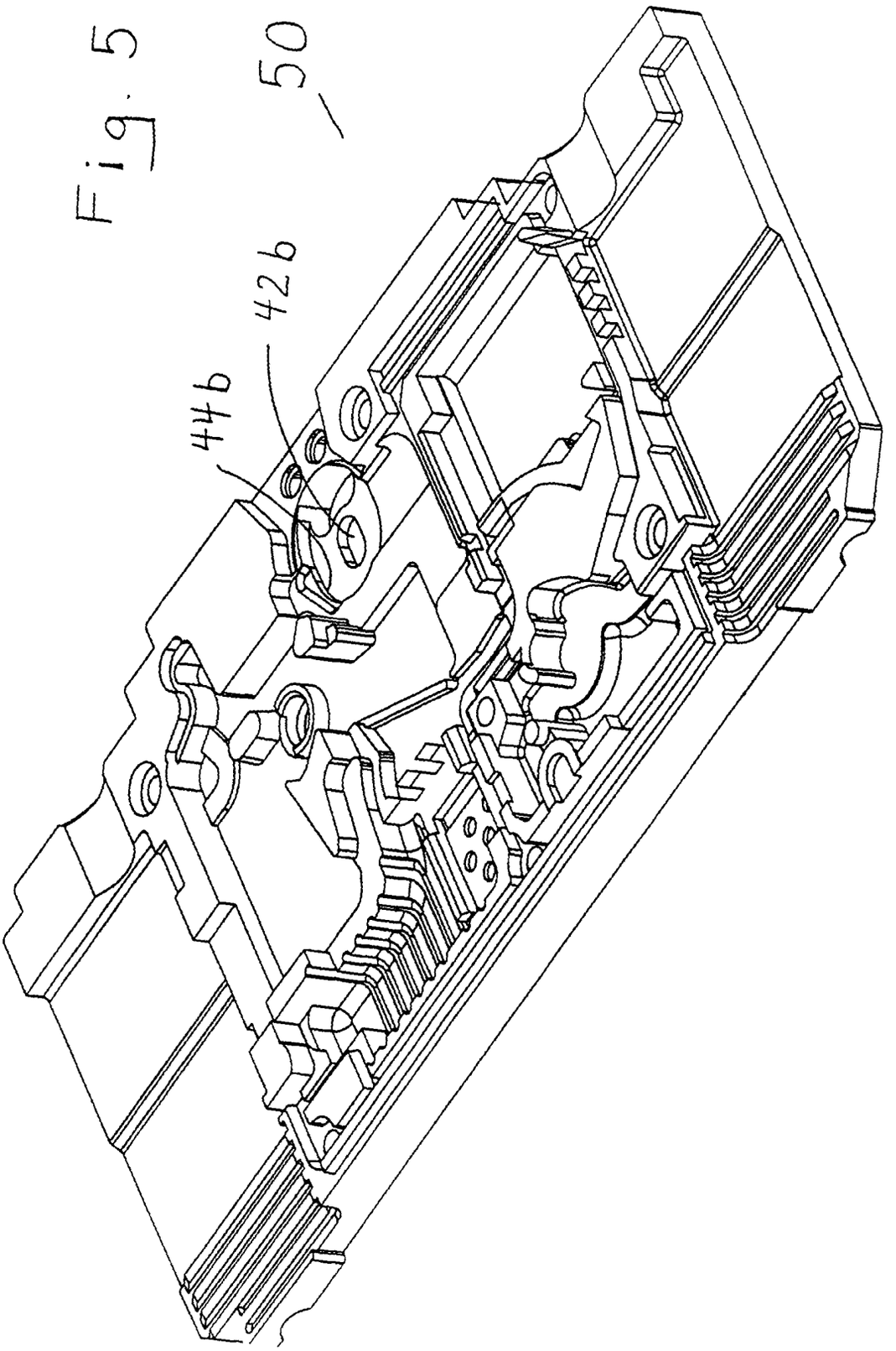


Fig. 5



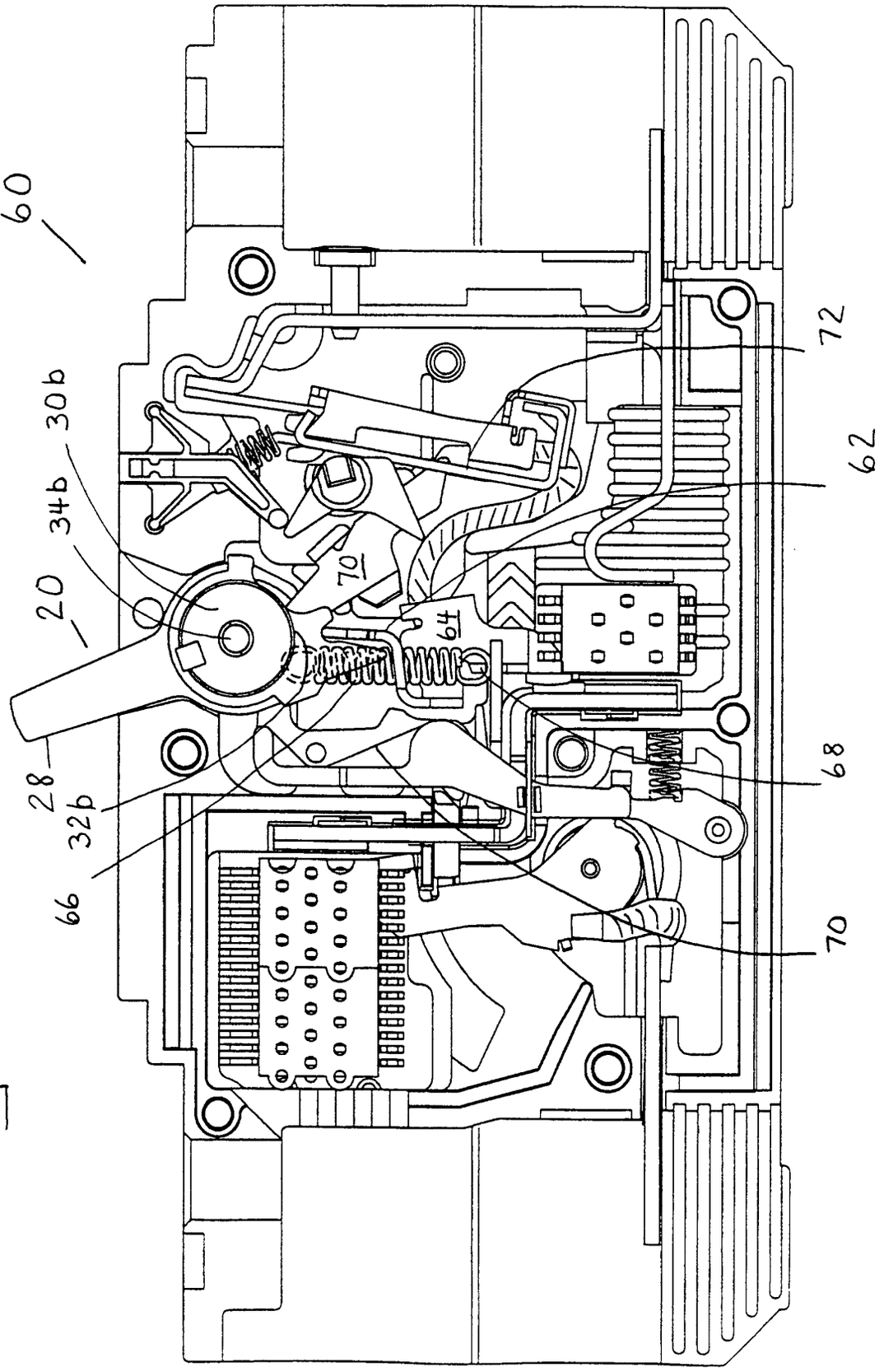


Fig. 6